

SURREBUTTAL TESTIMONY
OF
BRIAN HORII
ON BEHALF OF
THE SOUTH CAROLINA OFFICE OF REGULATORY STAFF
DOCKET NOS. 2019-185-E AND 2019-186-E
IN RE: SOUTH CAROLINA ENERGY FREEDOM ACT (H.3659)
PROCEEDING TO ESTABLISH DUKE ENERGY CAROLINAS, LLC’S AND
DUKE ENERGY PROGRESS, LLC’S STANDARD OFFER, AVOIDED COST
METHODOLOGIES, FORM CONTRACT POWER PURCHASE
AGREEMENTS, COMMITMENT TO SELL FORMS, AND ANY OTHER
TERMS OR CONDITIONS NECESSARY (INCLUDES SMALL POWER
PRODUCERS AS DEFINED IN 16 UNITED STATES CODE 796, AS
AMENDED) – S.C. CODE ANN. SECTION 58-41-20(A)

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS AND OCCUPATION.

A. My name is Brian Horii. My business address is 44 Montgomery Street, San Francisco, California 94104. I am a Senior Partner with Energy and Environmental Economics, Inc. (“E3”). Founded in 1989, E3 is an energy consulting firm with expertise in helping utilities, regulators, policy makers, developers, and investors make the best strategic decisions possible as they implement new public policies, respond to technological advances, and address customers’ shifting expectations.

1 **Q. DID YOU FILE DIRECT TESTIMONY AND AN EXHIBIT RELATED TO THIS**
2 **PROCEEDING?**

3 **A.** Yes. I filed direct testimony and an exhibit with the Public Service Commission of
4 South Carolina (“Commission”) on September 11, 2019.

5 **Q. WHAT IS THE PURPOSE OF YOUR SURREBUTTAL TESTIMONY?**

6 **A.** My surrebuttal testimony addresses the rebuttal testimony of Duke Energy
7 Carolinas, LLC’s (“DEC”) and Duke Energy Progress, LLC’s (“DEP”) (collectively
8 referred to as the “Companies”) witnesses Glen A. Snider, Steven B. Wheeler, and Nick
9 Wintermantel. Specifically, I will address the following topics:

- 10 1) modeling of the economic life of a combustion turbine (“CT”);
- 11 2) seasonal allocations of avoided capacity costs;
- 12 3) potential stakeholder process regarding future integration services charges;
- 13 4) assessment of solar integration costs based on average costs instead of incremental
14 costs; and
- 15 5) Companies’ characterization of ORS’s acceptance of solar integration costs in
16 South Carolina.

17 **I. SURREBUTTAL TO REBUTTAL TESTIMONY OF GLEN A. SNIDER.**

18 **Q. DO YOU AGREE WITH THE COMPANIES’ CLAIM THAT A 35-YEAR USEFUL**
19 **LIFE FOR A CT IS APPROPRIATE BECAUSE IT IS CONSISTENT WITH THE**
20 **COMPANIES’ 35-YEAR USEFUL LIFE ASSUMPTION AS REFLECTED IN THE**
21 **INTEGRATED RESOURCE PLANS (“IRP”) (SNIDER REBUTTAL, P. 51)?**

22 **A.** No. The Companies’ use of a 35-year useful life for avoided capacity costs is not
23 appropriate because the Companies failed to include appropriate fixed operating and

1 maintenance (“FOM”) costs as part of the total fixed costs for a CT. If the Companies’ goal
 2 is for avoided capacity costs to be consistent with the IRPs, the Companies should have
 3 included costs of major maintenance overhauls in FOM costs as part of the total fixed costs
 4 of a CT. It is via such expensive overhaul work that a CT’s life could be extended from
 5 twenty (20) to thirty-five (35) years. Table 1 below summarizes the two (2) correct methods
 6 for estimating CT avoided capacity costs: 1) use twenty (20) years with only minor
 7 maintenance costs in FOM, or 2) add major maintenance overhaul costs in FOM and extend
 8 the plant life to thirty-five (35) years.

9 *Table 1: Methods for Estimating Avoided Capacity Costs*

Item	Correct 20-Year Method	Correct 35-Year Method	Companies Proposed Method
Life of the CT	20 Years	35 Years	35 Years
Minor Maintenance Costs	Include	Include	Include
Overhaul Costs (Major Maintenance)	Exclude	Include in order to extend CT life to 35 years	Not included

10 For comparison, the last column of the table shows the Companies’ approach, and
 11 highlights that the Companies’ method did not include major maintenance costs. As a
 12 result, the way the Companies utilized thirty-five (35) years as the useful life of a CT was
 13 incorrect.

14 **Q. DO YOU AGREE WITH THE COMPANIES’ METHOD THAT INCLUDES**
 15 **MAJOR MAINTENANCE FOM COSTS ASSOCIATED WITH THE 35-YEAR**
 16 **ECONOMIC LIFE OF A CT IN THE MODELING OF AVOIDED ENERGY**
 17 **COSTS (SNIDER REBUTTAL, P. 52)?**

1 **A.** No. The Companies' approach is incorrect from both a theoretical and a practical
2 perspective. From a theoretical level, the avoided capacity cost is supposed to reflect the
3 full fixed costs of a new CT, and the avoided energy costs are supposed to represent the
4 change in variable costs for the total generation fleet. Therefore, because the Companies
5 failed to include the FOM costs for major maintenance in their calculation of avoided
6 capacity cost, the Companies' method underestimates the full fixed costs of a CT and is
7 fundamentally flawed. Moreover, from a practical perspective, moving the major FOM
8 costs into the calculation of avoided energy costs does not just entail a simple
9 reclassification of the costs, but essentially makes those costs disappear.

10 The Companies improperly minimize (or nearly eliminate) the cost of major
11 maintenance because of the way they calculate avoided energy costs. The Companies
12 model the major maintenance costs in PROSYM as an additional start cost for the CT. On
13 its face, this could be viewed as reasonable, however, avoided energy costs are calculated
14 as the difference in operating costs between 1) a base case and 2) a change case that
15 includes 100 megawatts ("MW") of free generation. Both the base case and the change
16 case would have substantial major maintenance costs, but almost none of these costs would
17 translate to avoided energy costs because they would mostly cancel out when calculating
18 the change in cost between the two (2) cases.

19 As an example, assume the change case had 1% fewer CT starts than the base. The
20 change case would have 99% of the major maintenance cost of the base case. However,
21 because the avoided energy cost is calculated by subtracting the change case costs from the
22 base case costs, the avoided energy costs would only reflect 1% of the major maintenance

1 costs (100% of costs minus 99% of costs). This clearly underestimates the cost of major
2 maintenance.

3 To clarify, consider the stylized example in Table 2 below which demonstrates the
4 result of the Companies' error in calculating the avoided energy costs. Assume the annual
5 FOM associated with major maintenance for a CT is \$20/MW each time the CT is started,
6 there are seven hundred fifty (750) starts modeled in PROSYM for the base case, and total
7 major maintenance costs during the year are \$15,000 (Column B). Further, assume that in
8 the PROSYM change case with the addition of 100 MW of new resources, the CT is not
9 required to start as often, and the resulting FOM costs for major maintenance drop to
10 \$14,000/MW because of fifty (50) fewer starts during the year (Column C). Subsequently,
11 both the base case and change case show substantial major maintenance costs, and the full
12 base case amount of \$15,000 would be included in the estimation of avoided capacity cost
13 (Column A). However, in the estimation of avoided energy costs, the change case costs are
14 subtracted from the base case costs. As a result, the amount of major maintenance costs is
15 only \$1,000/MW for the year (Column D).

Table 2: Major Maintenance Costs in Capacity vs Energy for one (1) Year

	A	B	C	D
	Treatment in Avoided Capacity Costs	PROSYM Base Case	PROSYM Change Case	Average Avoided Energy Cost for Major Maintenance
Major maintenance O&M (\$/MW)	\$15,000			
Major maintenance Cost per Start (\$/MW) Starts in the year		\$20 750	\$20 700	
Major maintenance cost (\$/MW)		\$15,000	\$14,000	\$1,000
Hours per year				8,760
Major maintenance cost (\$/kWh)				0.0001

Q. PLEASE EXPLAIN HOW THE ESTIMATED AVOIDED CAPACITY COSTS SHOULD BE CALCULATED TO CORRECTLY REFLECT A 35-YEAR ECONOMIC LIFE OF A CT.

A. To correctly model a CT with a 35-year economic life, the Companies should have increased the FOM costs included in the estimate of avoided capacity costs to properly reflect the much higher cost of major maintenance required to extend the life of the CT.

Q. PLEASE COMPARE CORRECTLY CALCULATED 35-YEAR CT AVOIDED CAPACITY COSTS TO THE AVOIDED CAPACITY COSTS YOU RECOMMENDED IN YOUR PREVIOUSLY FILED DIRECT TESTIMONY.

A. Correctly calculated 35-year CT avoided capacity costs are nearly the same as those I proposed in my direct testimony. Including the higher costs of major maintenance in the forecast of FOM costs and a 35-year economic life, results in avoided capacity costs that are 1% lower than my recommendation for DEC and 2% lower than my recommendation for DEP.

1 To perform this comparison, I estimated the cost of the major maintenance using
2 the PJM Cost of New Entry report ¹ that provides estimates for FOM related to minor and
3 major maintenance. The costs of minor maintenance were generally consistent with what
4 the Companies used for FOM, but the costs of major maintenance average 4.8 times the
5 cost of minor maintenance (across the PJM cost areas). Therefore, I multiplied the DEC
6 and DEP minor maintenance FOM costs by a factor of 4.8 to reflect the higher costs
7 associated with major maintenance needed to extend the economic life of the CT to thirty-
8 five (35) years. Thus, my analysis accounted for the lower costs of operating in South
9 Carolina.

10 I present avoided capacity rates based on my calculation of the cost of a 35-year
11 CT later in this testimony.

12 **Q. DO YOU AGREE WITH THE COMPANIES' ASSERTION THAT BASING THE**
13 **SEASONAL ALLOCATION ON ANYTHING LESS THAN "TRANCHE 4"**
14 **WOULD ESSENTIALLY RESULT IN DOUBLE COUNTING AND**
15 **OVERPAYMENT FOR SOLAR QF CAPACITY BY THE COMPANIES'**
16 **CUSTOMERS (SNIDER REBUTTAL, P. 63)?**

17 **A.** No. The total "Tranche 4" MW of renewable generation contemplated in the
18 Competitive Procurement of Renewable Energy ("CPRE") Program is mandated by North
19 Carolina law (HB589) to be integrated by a certain date in the future. However, avoided
20 costs should be calculated based on current conditions. Specifically, Act 62 states "[e]ach

¹ <https://www.pjm.com/~media/committees-groups/committees/mic/20180425-special/20180425-pjm-2018-cost-of-new-entry-study.ashx>

1 electrical utility's avoided cost methodology fairly accounts for costs avoided by the
2 electrical utility or incurred by the electrical utility...". "Tranche 4" represents an amount
3 of future solar that has not yet committed to a contract price for power. As such, there is
4 no overpayment risk because future solar will be evaluated based on avoided cost rates that
5 exist at that time in the future. To be sure, if the future solar were paid based on higher
6 avoided costs from the past, there would be an overpayment risk, but that risk would have
7 nothing to do with the Qualifying Facilities' ("QF") solar.

8 If avoided cost rates are calculated correctly, as I propose, they would reflect the
9 cost conditions that exist at the time any contracts are signed. Overpayment would only
10 occur if one group of solar QFs were paid based on a cost higher than actual avoided cost
11 levels.

12 By updating the avoided capacity rates regularly (at least every twenty-four (24)
13 months per Act 62), little risk of overpayment to solar QFs would exist. To the extent
14 avoided capacity costs decline, the decrease in costs would be reflected in the avoided
15 capacity rates for the next group of solar QFs, as it should also be reflected in the evaluation
16 of future CPRE Program solar. Each group of solar resources should be evaluated or
17 credited with avoided rates that accurately reflect system conditions at the time any contract
18 commitments occur. To do otherwise would unduly discriminate between solar
19 resources.

20 **Q. BASED ON INFORMATION THE COMPANIES PROVIDED IN REBUTTAL**
21 **TESTIMONY ABOUT THE CPRE PROGRAM, DOES YOUR**
22 **RECOMMENDATION FOR THE SEASONAL ALLOCATION OF AVOIDED**
23 **CAPACITY COSTS CHANGE?**

1 **A.** Yes. In developing my original recommendations, I relied on the amount of
2 currently installed solar to define “current conditions” for the purpose of estimating the
3 seasonal capacity value of the next group of solar resources. Therefore, I relied on the
4 “Existing plus Transition” scenario versus the Companies’ “Tranche 4” scenario. From
5 further information obtained through discovery, I have since learned that nearly 100% of
6 the projects with signed interconnection agreements and PPAs have resulted in completed
7 in-service projects over the past three (3) years. Accordingly, it is appropriate, in my
8 opinion, to include the capacity from signed CPRE contracts in the determination of
9 “current conditions” for avoided cost purposes, as the next group of solar is essentially
10 incremental to those signed projects. I would note that these projects have signed contracts
11 and established prices and are different from the “Tranche 4” future solar previously
12 discussed that have neither signed contracts nor fixed prices.

13 In my direct testimony I recommended seasonal allocation factors based on the
14 Loss of Load Expectation (“LOLE”) from the Companies’ “Existing Plus Transition” solar
15 penetration case. With the signed CPRE contracts, solar penetration is comparable to the
16 “Tranche 1” case, and I now recommend seasonal allocation factors based on the “Tranche
17 1” case. Using the same method described in my direct testimony, I calculated updated
18 allocation factors shown below in Table 3 compared to DEC’s proposed values and those
19 I recommended in my direct testimony.

Table 3: Capacity Cost Allocation Factors for DEC

PERIOD	DEC PROPOSED	E3 DIRECT	E3 SURREBUTTAL
SUMMER	10%	40%	30%
WINTER MORNING	68%	48%	52.5%
WINTER EVENING	22%	12%	17.5%

Q. PLEASE EXPLAIN THE CAPACITY RATES YOU CALCULATED FOR DEC USING THE UPDATED SEASONAL ALLOCATION FACTORS AND CONSIDERING THE 35-YEAR ECONOMIC LIFE OF A CT.

A. Table 4 below provides a comparison of DEC's proposed 10-Year fixed avoided capacity rates, the rates recommended in my direct testimony, and my adjusted calculations using the updated seasonal allocations from Table 3. I did not recalculate DEC's proposed variable and 5-year fixed avoided capacity rates as there is no identified need for additional system capacity for DEC within the next five (5) years.

Table 4 also reflects my calculations for avoided capacity fixed rates should the Commission approve values based on a CT with a 35-year economic life that includes the appropriate fixed costs. As I discussed above, when properly calculated to include the cost of major maintenance, the avoided capacity cost of a 35-year CT is very close to that of the 20-year CT without major maintenance costs.

Table 4: E3 and DEC 10-Year Fixed Avoided Capacity Rates (Distribution)

	Summer On-Peak	Winter AM On-Peak	Winter PM On-Peak
DEC Proposed (¢/kWh)	0.86	3.99	1.29
E3 Direct Testimony (20 Years) (¢/kWh)	4.40	3.60	0.90
E3 Surrebuttal (20 Years) (¢/kWh)	3.30	3.94	1.31
E3 Surrebuttal (35 Years) (¢/kWh)	3.26	3.89	1.30

The season and on-peak period definitions remain unchanged from DEC's proposal.

Q. DO YOU RECOMMEND ANY CHANGES FOR DEP'S SEASONAL ALLOCATIONS OF AVOIDED CAPACITY COSTS?

A. No. Using the LOLE from the "Tranche 1" case for DEP results in the same seasonal allocations as I recommended in my direct testimony.

Q. WHAT AVOIDED CAPACITY RATES DID YOU CALCULATE FOR DEP CONSIDERING THE 35-YEAR ECONOMIC LIFE OF A CT?

A. Table 5 below provides a comparison of DEP's proposed avoided capacity rates to the calculations in my direct testimony using the 20-year economic life of a CT and my calculations using the 35-year economic life of a CT which includes the cost of major maintenance. As reflected below in Table 5, the 35-year calculations are almost the same as the 20-year CT results.

1 *Table 5: E3 and DEP Avoided Capacity Rates (Distribution)*

	Summer On-Peak	Winter AM On-Peak	Winter PM On-Peak
Variable Rate Calculation			
DEP Proposed (¢/kWh)	0.00	10.82	4.64
E3 Direct Testimony (20 Years) (¢/kWh)	0.29	13.69	5.95
E3 Surrebuttal (35 Years) (¢/kWh)	0.29	13.68	5.95
5-Year Fixed Rate Calculation			
DEP Proposed (¢/kWh)	0.00	11.03	4.73
E3 Direct Testimony (20 Years) (¢/kWh)	0.30	13.95	6.07
E3 Surrebuttal (35 Years) (¢/kWh)	0.30	13.94	6.06
10-Year Fixed Rate Calculation			
DEP Proposed (¢/kWh)	0.00	11.36	4.87
E3 Direct Testimony (20 Years) (¢/kWh)	0.30	14.37	6.25
E3 Surrebuttal (35 Years) (¢/kWh)	0.30	14.36	6.24

2 **Q. WHICH USEFUL LIFE CALCULATION DO YOU RECOMMEND THE**
3 **COMMISSION CONSIDER IN THIS CASE?**

4 **A.** The similarity of my calculations in my direct testimony using a 20-year economic
5 life to the avoided capacity costs obtained using a 35-year economic life, including a FOM
6 that reflects major maintenance, should provide the Commission comfort as to the
7 appropriateness of the recommendation I provided in my direct testimony. Basically, one
8 can calculate avoided capacity costs using FOM that reflects minor maintenance needed to
9 keep the CT operating for twenty (20) years, or higher FOM that reflects major overhaul
10 maintenance needed to extend the CT life to thirty-five (35) years. Both approaches
11 produce nearly the same result.

1 I affirm my recommendation the Commission approve the 20-year economic life
2 for calculating avoided costs because that is consistent with data sources such as the U.S.
3 Energy Information Administration (“EIA”) report ². I have concerns that in the future,
4 analysts may fail to apply the modifications to the FOM shown in sources like the EIA
5 report and thereby underestimate avoided capacity costs. In addition, it may be more
6 difficult in the future to develop the appropriate FOM costs that include major
7 maintenance. Using the 20-year economic life would eliminate those problems.

8 **Q. WHAT DO YOU RECOMMEND THE COMMISSION APPROVE FOR AVOIDED**
9 **CAPACITY RATES?**

10 **A.** For DEP, the Commission should approve the avoided capacity rates I
11 recommended in my direct testimony. For DEC, the Commission should approve the 20-
12 year economic life calculations from Table 4 above for the 10-Year fixed rate, and the
13 variable and 5-year rates as recommended in my direct testimony.

14 However, should the Commission decide a 35-year economic life for a CT is more
15 appropriate, the Commission should approve my values presented in Tables 4 and 5 of this
16 surrebuttal testimony.

17 **Q. THE COMPANIES ASSERT ORS AND AN INDEPENDENT THIRD PARTY,**
18 **SUCH AS E3, SHOULD FACILITATE A FORMAL STAKEHOLDER PROCESS,**
19 **OR TECHNICAL WORKSHOP, AND REPORT TO THE COMMISSION**
20 **REGARDING FUTURE INTEGRATION SERVICES CHARGES (SNIDER**

² US EIA, Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2019
<https://www.eia.gov/outlooks/aeo/assumptions/pdf/table 8.2.pdf>

REBUTTAL, P. 86). WHAT IS ORS'S POSITION?

A. ORS acknowledges, “[i]t is the duty and responsibility of the regulatory staff to: . . . to serve as a facilitator or otherwise act directly or indirectly to resolve disputes and issues involving matters within the jurisdiction of the commission...” However, ORS is a statutory party to the review process that determines the Companies’ compliance with Act 62 and the Public Utility Regulatory Policies Act of 1978 (“PURPA”) as well as the process to recommend any changes and updates to the Companies’ calculations of future integration services charges. ORS is required to provide recommendations that reflect its statutory mission.

II. SURREBUTTAL TO REBUTTAL TESTIMONY OF STEVEN B. WHEELER

Q. DO YOU AGREE WITH THE COMPANIES’ CLAIM THAT SOLAR INTEGRATION COSTS SHOULD BE CHARGED BASED ON AVERAGE COSTS, INSTEAD OF INCREMENTAL COSTS, SINCE INTEGRATION COSTS ARE GENERALLY CAUSED BY ALL UNCONTROLLED INTERMITTENT GENERATORS (WHEELER REBUTTAL, PP. 27-28)?

A. No. Although the need for new generation capacity is determined by the aggregate peak of all loads and output from all generators, I am not familiar with any utility applying average avoided capacity rates. PURPA directs that marginal or incremental costs should be the basis for QF rates, and that same principle should be maintained for solar integration costs.

Q. THE COMPANIES MADE SEVERAL ADJUSTMENTS TO THE FORM PPA IN REBUTTAL TESTIMONY (WHEELER REBUTTAL, PP. 6-8). DO THE COMPANIES’ ADJUSTMENTS ADDRESS ORS’S CONCERNS?

1 **A.** Yes.

2 **III. SURREBUTTAL TO REBUTTAL TESTIMONY OF NICK WINTERMANTEL**

3 **Q.** **PLEASE CLARIFY THE COMPANIES CHARACTERIZATION OF YOUR**
4 **DIRECT TESTIMONY, SPECIFICALLY YOUR COMMENT “THE RESULTS OF**
5 **THE ASTRAPÉ STUDY ARE REASONABLE FOR THE STATE OF SOUTH**
6 **CAROLINA” (WINTERMANTEL REBUTTAL, P. 10).**

7 **A.** I do find the estimates for the lower levels of solar penetration to be reasonable.
8 However, as I state in my direct testimony, I have concerns about the estimation of the
9 solar integration services charges. Given the way the Companies’ estimated charges
10 increase with higher levels of solar penetration, I would not recommend the results of the
11 Companies’ integration study be adopted for higher solar penetration levels at this time. In
12 my direct testimony I recommend the Commission adopt the integration services charges
13 as calculated by the Companies as the highest charge to be applied – an upper limit to the
14 integration services charges. Higher integration services charges for future solar in future
15 proceedings may be warranted, but any such charges should be justified via a new
16 integration cost study.

17 **IV. SUMMARY OF RECOMMENDATIONS**

18 **Q.** **WHAT CHANGES DO YOU RECOMMEND BASED ON YOUR REVIEW OF THE**
19 **COMPANIES’ REBUTTAL TESTIMONY?**

20 **A.** I recommend the Commission modify DEC’s 10-year fixed avoided capacity rate
21 for Standard Offer contracts as calculated and displayed in Table 4 using my updated
22 seasonal allocations and a 20-year economic life of a CT. And, I recommend the
23 Commission approve all previous recommendations stated in my direct testimony.

1 **Q. WILL YOU UPDATE YOUR TESTIMONY BASED ON INFORMATION THAT**
2 **BECOMES AVAILABLE?**

3 **A.** Yes. ORS fully reserves the right to revise its recommendations via supplemental
4 testimony should new information not previously provided by the Company, or other
5 sources, become available.

6 **Q. DOES THIS CONCLUDE YOUR SURREBUTTAL TESTIMONY?**

7 **A.** Yes, it does.